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Wireless Advertising Gets Support from Consumers

Wireless phones may indeed join newspapers, radio, and television as a sponsored delivery medium for information, shopping, and entertainment services, according to a study of voice and wireless commerce conducted by The Kelsey Group and ConStat, Inc.

The "Wireless Commerce Monitor" found that wireless users are ready to treat their phones as advertiser-sponsored sources of frequently needed information, such as traffic reports, news, weather, stocks, and e-mail, including promotional messages. In the study, almost 50 percent of wireless users who indicated a payment preference for receiving wireless information said they would opt for an advertising-supported model over a monthly or per-use, fee-based model.

"This marks the next step in the inexorable move toward advertiser-supported delivery of free services to the fast growing market wireless market," said Neal Polachek, senior vice president of research and consulting at The Kelsey Group. "It also indicates that local advertisers are connecting the dots and expect to be able to beam their marketing messages to targeted, wireless users."

The study also found that small businesses that advertise are considerably more interested in mobile advertising today than they were 12 months. Since the first wave of the research was conducted last year, interest levels have nearly tripled, jumping from 8 percent to nearly 30 percent.

"We're witnessing the birth of wireless media," said

Related item: The number of Web-enabled cellular handsets is expected to reach a 95 million in 2004 but marketers must resist imposing their Web strategy to reach these users, according to research by Jupiter Communications. Read Web Marketing Tactics Won't Work in Wireless Arena

Daniel Miller, senior vice president of The Kelsey Group. "The early users of enhanced wireless services expect advertising to keep services free-of-charge. Both national and local marketers will take advantage of the new media's ability to deliver more targeted advertising and promotions based on both personal preferences and geographic location."

Text advertising on wireless devices got a vote of confidence recently thanks to one European study that positive consumer response to an SMS message.

A study by Engage UK and mobile Internet company Quios that examined consumer acceptance of wireless text advertising found a positive response rate among 79 percent of participants and an average 60 percent recall rate of the trial's three participating big brand sponsors.

The study, which originated in the UK, examined results from Quios' Euro 2000 SMS Alert service, which it offered its members in June of 2000. The service delivered more than 2.5 million message alerts, delivered to more than 30,000 cell phones in more than 100 nations. The alerts were sent to notify consumers when goals were scored by their favorite team, or to send final scores of the soccer tournament. The alerts were sponsored by Sega Dreamcast, Grolsch Beer, and Sports.com. Third-party research firm Harvey Research surveyed 500 mobile phone users who signed up for the service.

"The explosion of wireless mobile devices presents a phenomenal new business opportunity for marketing service providers," said Paul Schaut, President and CEO of Engage. "Wireless presents us with an ideal opportunity to understand the customer and to deliver ads and promotions to match their needs."

internet.com's Wireless Services survey, a survey of more than 1,000 Internet professionals, found that 86 percent of its respondents consider advertising on wireless devices to be intrusive. But when asked how they would feel about wireless marketing if it helped reduce the cost of their wireless services, 50 percent warmed to the idea of accepting advertising

messages.

October 10, 2000

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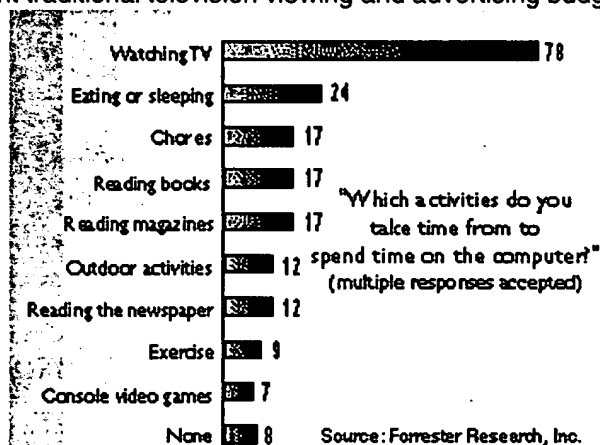
http://www.internet.com

IAB
Advertising ABC's

Why Internet Advertising? by Tom Hyland

Ironic, isn't it, that just 40 years ago television was considered "new media"? And just 15 years ago cable wore the same badge. During their respective early days, each of these "new media" had to prove their value to earn a spot on the media plan-the same position the Internet finds itself in today.

Does Internet advertising belong on your media plan? This is the question everyone is asking. CEO's are asking their brand managers. Brand managers are asking their agency account managers and account managers are asking their media departments.The answer most certainly is YES - regardless of the brand you manage or the category in which that brand competes. Look at the facts:

Fact:Television Audiences are Migrating to the Net

The erosion of the network television audience during the 1980s and 1990s changed media plans forever. In the early '80s, television was simple to plan and buy with just three networks to consider. Then came cable, then a fourth network called FOX, followed by a dizzying array of syndicated offerings and yet more new network entries: Paramount and the WB. New choices continued to fragment traditional television viewing and advertising budgets soon followed

Activity	Value
Watching TV	78
Eating or sleeping	24
Chores	17
Reading books	17
Reading magazines	17
Outdoor activities	12
Reading the newspaper	12
Exercise	9
Console video games	7
None	8

"Which activities do you take time from to spend time on the computer?" (multiple responses accepted)

Source: Forrester Research, Inc.

this trend.

Television's recent history has demonstrated that media budgets ultimately are pragmatic. As audiences migrate, media plans follow, acknowledging that the ultimate goal of any brand is to reach its target audience effectively and efficiently. The exploding media landscape of the 90s-driven by increased TV audience fragmentation and the Web's popularity-have put this process into overdrive. Like the 80s and early 90s, media planners are, again, adapting their plans to account for the ever-growing numbers of people spending increasing amounts of time online at the expense of other media.

The first evidence of this audience migration appeared last summer in a Forrester Research report. The researchers asked PC users which activities they were giving up to spend more time on their computers. And, while 24% did admit giving up eating or sleeping to pound away on the PC, the activity sacrificed by over three-quarters of the respondents was television. Shortly after the Forrester findings were published, a study from The Georgia Institute

of Technology's Graphic, Visualization and Usability Center (GVU) was released. This study, conducted on the Internet, asked users about their television viewing habits and what impact the Net might have on them. Their findings indicated a distinct shift in media habits with almost 37% of respondents claiming that they "use the Web instead of watching TV on a daily basis." Earlier this year, MSNBC noted the fact that Nielsen's February ratings sweeps found one million fewer U.S. households watching prime time television versus the same period last year. Simultaneously, Nielsen and CommerceNet released their Internet study, reporting that the North American online audience had doubled in the past 18 months. Clearly the conclusions of these two studies are far from coincidence. Taken alone, this migration of the television viewing audience to the Internet is particularly striking. This data is made even more impressive by the fact that Internet users are remarkably upscale. So, not only are we witnessing a fundamental shift in media habits, the Internet audience represents that hard-to-reach, well-educated, high income population most coveted by marketers.

Fact: The Net is the Fastest Growing Medium in History

Internet advertising began in 1994, when the first banner ads were sold (Hotwired, October 1994) and the first commercially available Web browser, Netscape Navigator 1.0, was released (November 1994). In a recent study, Mary Meeker, Managing Director, Morgan Stanley, and her team of researchers closely examined the adoption rate of the Internet, contrasted to the three other major "new media" invented this century: radio, network television and cable TV. As a common metric, they examined the number of years it took or will take for each media to reach 50 million U.S. users. With television, cable and radio included for historical context, the growth of the Net is nothing short of remarkable. Meeker estimates the Internet will capture 50 million users in just five years. It took TV 13 years and radio 38 years to reach this milestone. **Fact: Internet Demographics are a Marketer's Dream** Every major research organization has studied the demographic composition of the Internet. While methodologies and approaches vary, the findings are consistent: Net users are young, well-educated and earn high incomes. And, increasingly, research shows that both men and women are using the Internet. Some topline findings from some of the more recent surveys are summarized on the following page.
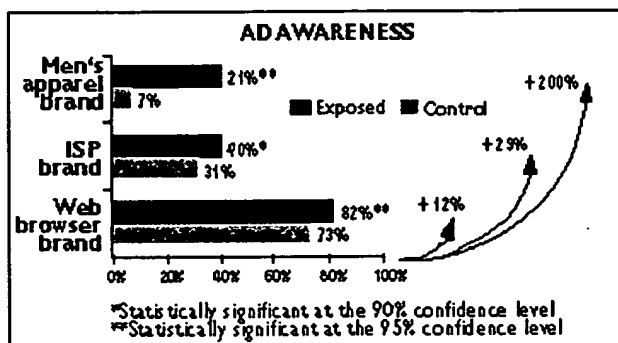
GENDER The March 1997 CommerceNet/Nielsen survey of Internet Demographics found that women now represent over 42% of the online population. Source: Nielsen/CommerceNet

AGE The average age of Web users is 34.9 years old, according to the 6th GVU WWW User Survey. This average age has been steadily increasing over the last several GVU surveys. (Fourth Survey: 32.7 years, Fifth Survey: 33.0 years, Sixth Survey: 34.9 years) Source: Georgia Institute of Technology, Graphics, Visualization & Usability Center (GVU), 1997 **INCOME A 1996**

survey by the Media Futures Program of SRI Consulting revealed that more than 65% of Internet users have household incomes of $50,000 or more, compared with 35% of the U.S. population as a whole (index 186). According to the sixth GVU study, average household income of Internet users is $60,800 (US). The distribution of income levels is very similar to the Fifth GVU survey: Less than $29K: 18.8%, $30-50K: 23.0%, over $50K: 41.1%. Sources: SRI International; GVU, 1997. **EDUCATION** According to the same SRI study, more than 75% of Internet users have attended college, as opposed to 46% of the total U.S. population (index 163). Source: SRI International **Fact: Web ad banners build brand awareness and may be better at generating awareness than television or print advertising.** Since their first appearance on commercial Web pages, the value of banner ads has been debated. Many felt they were physically too small to offer much branding and some advertisers convinced themselves that click-through was the only metric by which to measure ad effectiveness. They erroneously believed
- despite the fact that no research existed to support their belief
- that without a click-through, no brand building would occur.
In fall 1996, Millward Brown International set out to test the impact of banners on brand awareness, the first study of its kind. Millward Brown's objective was to measure the impact of a single ad banner exposure on brand awareness. The three brands tested included a men's apparel brand, a telecommunications brand and a technology company. The findings were significant and conclusive for each brand. Awareness was significantly greater among the banner-exposed (test) group than the non-exposed (control) group. Specifically, exposure to the ad banners alone increased brand awareness from 12% to 200% in a banner-exposed group. The study also compared the impact of the banner ads in this test to television and magazine norms from prior Millward Brown studies. The findings were remarkable: Single exposure to a Web banner generated greater awareness than a single exposure to a television or print ad. Millward Brown used their FORCE score ("First Opportunity to See Reaction Created by the Execution") as a means of evaluating the impact of the ad banners relative to other media.

Adoption Curves for Various Media—The Web is Ramping Fast
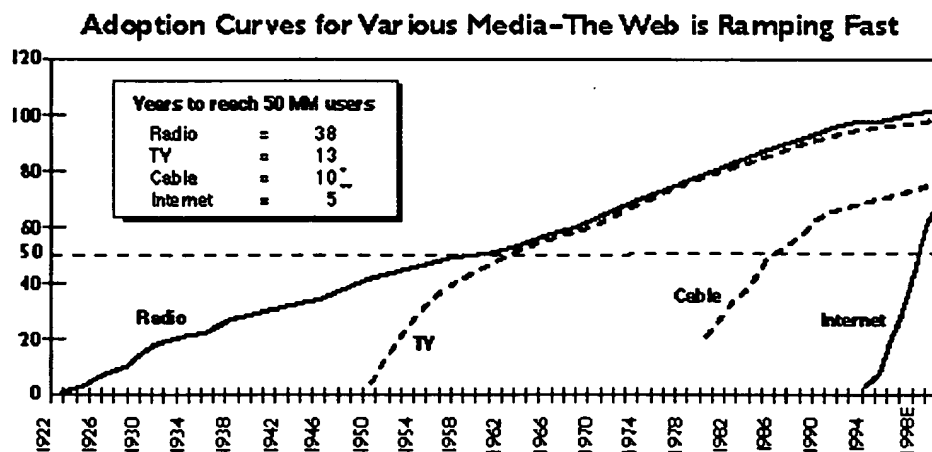
Source: Morgan Stanley Technology Research. E=Morgan Stanley Research Estimate.
*The launch of HBO in 1976 was used to estimate the beginning of cable as an entertainment / advertising medium. Though cable technology was developed in the late 1940s, its initial use was primarily for the improvement of reception in remote areas. It was not until HBO began to distribute its pay-TV movie service via satellite in 1976 that the medium became a distinct content and advertising alternate to broadcast television.
**Morgan Stanley Technology Research Estimate

A FORCE score indicates the effects of time, exposure weight, diminishing returns and base level. As such, FORCE scores can be directly compared across media types. As the median FORCE score for television advertisements is 10, the scores reported in the chart below (with an average score of 20 for

the Web banners tested) suggest that Web banners tested very favorably to most TV ads, in terms of creating brand-linked awareness.

Now You Know the Facts Every new medium has had to prove its value to advertisers. Just 15 short years ago, cable television fought to earn the respect of advertisers. Today it is a $6 billion industry. Those of us in Internet Publishing realize the Internet is no exception. We accept the challenge to prove the value of this medium and will build the case with facts-not hype- for including the Internet on your media plans. All these facts in aggregate create an undeniably compelling case for advertisers today to include the Internet in their media plans. As Lynn Upshaw, author of Building Brand Identity, noted recently, "The World Wide Web will be one of the strongest brand building tools available." Based on the facts at hand, we couldn't agree more. n

Acknowledgments: The IAB would like to thank the following organizations for permitting us to reprint their research and quote from their analysis: Morgan Stanley, Forrester Research, MSNBC, The Georgia Institute of Technology's Graphic, Visualization and Usability Center, SRI International, CommerceNet/Nielsen and Millward Brown International.
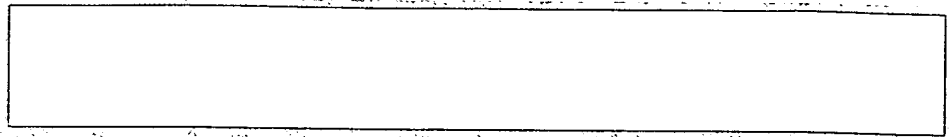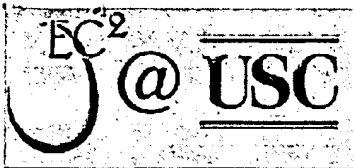
Occupants

Members

Service Providers

Alliances

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Internet Advertising History

Internet Advertising History details past efforts and standards for measuring Internet traffic.

April 1994

- Laurence Canter and Martha Siegel Legal Services spam the Internet.

August 1994

- Only 12 percent of 280 top executives polled by Ad Age said their agency was equipped to help them market via the Internet.

October 1994

- HotWired launches with the first banner ads on the Internet. Advertisers include AT&T, MCI, Sprint, Volvo and others.

- Time Warner opens Pathfinder service with ads from AT&T; Ziff Davis launches ZD Net on the Web.

November 1994

- The NCSA Mosaic What's New Page on the Net says it's seeking sponsors.

- CMP Publications deploys TechWeb ezine. Advertisers include AT&T, MCI, and Tandem Computers.

- WebConnect advertising media kit is placed on the web.

January 1995

- Five advertisers join Vibe Online, paying $40,000 for 6 months. Advertisers include: MCI, Saturn, Timex, Jim Bean, and AirWalk.

[**Top**]

February 1995

- Proctor & Gamble names Grey Interactive its interactive agency of record.

- CBS launches its web site.

- ESPN starts pitching advertisers on $1 million charter sponsorships of its site and other online properties.

March 1995

- Yahoo! goes commercial.

- Ragu opens its web site. It is the first packaged goods marketers to do so.

- AT&T picks Modem Media as its interactive agency of record.

- WebConnect signs "First 100" member sites to its advertising network.

April 1995

- Time Warner's Pathfinder signs its first advertisers, AT&T and Saturn. Ads cost $30,000 per quarter. ZD Net also begins to post ads.

- NetCount and Internet Profiles, two web audience tracking firms, launch their services.

- Interactive Traffic, an online media planning firm opens.

- Interactive Imaginations launches Riddler, a gaming site

that incorporates marketer sites as clues.

- Internet Advertising Council convenes.

May 1995

- Sun introduces Java programming language.

July 1995

- Forrester Research reports that online ad spending will total $37 million for the year.

- InfoSeek and Netscape shift to a CPM model to sell Web Ads.

- Agency Poppe Tyson starts selling ad space for Netscape and Playboy.

[**Top**]

August 1995

- Microsoft launches Microsoft Network (MSN) online service.

- Kraft and Proctor & Gamble register 184 domain names on the Internet.

September 1995

- ESPNET SportsZone signs advertisers to contracts totaling more than $1 million.

October 1995

- Audit Bureau of Circulations starts testing audits of Web sites.

- Poppe Tyson spins off its Web ad sales unit as DoubleClick.

January 1996

- Microsoft pays $200,000 to

sponsor the Super Bowl Web site.

- The New York Times launches on the Web with $120,000-per-year sponsors Toyota and Chemical Bank.

- NetGravity introduces the AdServer ad management system for web sites.

- Jupiter Communications estimates ad expenditures for January at $7.3 million.

February 1996

- FocalLink Communications introduces SmartBanner media planning services.

- PointCast launches its "push" news and information network featuring animated ads.

[**Top**]

March 1996

- Sony Corporation of America announces it's looking for partners for its upcoming Sony Station Web site. Partners are to pay $500,000 to $1,000,000.

April 1996

- Yahoo! allows Proctor & Gamble to pay for ads based solely on click-throughs rather than ad impressions.

- Juno Online Services launches a free, ad- supported e-mail service. Freemark Communications follows with a similar product.

- The Wall Street Journal launches its "Interactive Edition".

May 1996

- iVillage receives $800,000 in ad commitments using an ad model that combines editorial with marketing.

- FocalLink Communications introduces Market Match Web media planning tool.

June 1996

- Microsoft's ezine Slate debuts.

- Levi's Dockers division signs on for a one-year sponsorship of HotWired's Dream Jobs channel.

July 1996

- AT& T launches its intermercial ad campaign which features animated banners.

[**Top**]

August 1996

- Poppe Tyson files for an IPO.

- Privacy advocates heighten industry awareness on potential invasiveness of cookie technology.

September 1996

- General Motors doubles its web site content to more than 38,000 pages, making it one of the web's largest marketer sites.

- BackWeb Technologies introduces a private online broadcast system, with GM as one of the first users.

October 1996

- The Coalition for Advertising Supported Information and Entertainment (CASIE) issues proposed guidelines for Web ad banners.

December 1996

- In 1996, Companies spent $301 millions dollars in Web advertising. Consumers spent $1.3 billion on-line. And the number of households online reached 15.2 million.

February 1997

- Proposal by Bell Labs Information Science Research Center calling for new cookie standards is submitted to the Internet Engineering Task force. The proposal would allow for the voluntary disabling of cookies.

[**Top**]

March 1997

- Yahoo! makes $25 million advertising commitment to Netscape.

- Microsoft acquires Interse, developer of web site analysis software, to be integrated into BackOffice.

- The Internet Local Advertising & Commerce Association (ILAC), a not-for-profit organization designed to promote and facilitate local advertising and commerce between buyers and sellers on the Internet.

April 1997

- Time Inc. New Media agrees to syndicate Pathfinder content on AT& T's World-Net.

- Microsoft announces plans to purchase WebTV.

- PointCast Inc. contracts with the Audit Bureau of Verification Services to perform the first-ever audit of traffic on its popular Internet broadcast service.

The contents of this timeline were adapted from information provided by Advertising Age, The Direct Marketing Association and Morgan Stanley & Co.

[**Top**]

Digital Commerce Center Home Page	**Digital Commerce Center Contact Us**	**Digital Commerce Center Site Map**

Hobbes' Internet Timeline v5.6

by

Robert H'obbes' Zakon
Internet Evangelist

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If you enjoy the Timeline or make use of it in some way, please consider <u>a contribution</u>.

1950s

1957

USSR launches Sputnik, first artificial earth satellite. In response, US forms the Advanced Research Projects Agency (ARPA), the following year, within the Department of Defense (DoD) to establish US lead in science and technology applicable to the military (:amk:)

1960s

1961

Leonard Kleinrock, MIT: "Information Flow in Large Communication Nets" (May 31)
- First paper on packet-switching (PS) theory

1962

J.C.R. Licklider & W. Clark, MIT: "On-Line Man Computer Communication" (August)
- *Galactic Network* concept encompassing distributed social interactions

1964

Paul Baran, RAND: "On Distributed Communications Networks"
- Packet-switching networks; no single outage point

1965

ARPA sponsors study on "cooperative network of time-sharing computers"
- TX-2 at MIT Lincoln Lab and AN/FSQ-32 at System Development Corporation (Santa Monica, CA) are directly linked (without packet switches) via a dedicated 1200bps phone line; Digital Equipment Corporation (DEC) computer at ARPA later added to form "The

Experimental Network"

1966

Lawrence G. Roberts, MIT: "Towards a Cooperative Network of Time-Shared Computers" (October)
- First ARPANET plan

1967

ARPANET design discussions held by Larry Roberts at ARPA IPTO PI meeting in Ann Arbor, Michigan (April)

ACM Symposium on Operating Principles in Gatlinburg, Tennessee (October)
- First design paper on ARPANET published by Larry Roberts: "Multiple Computer Networks and Intercomputer Communication
- First meeting of the three independent packet network teams (RAND, NPL, ARPA)

National Physical Laboratory (NPL) in Middlesex, England develops NPL Data Network under Donald Watts Davies who coins the term packet. The NPL network, an experiment in packet-switching, used 768kbps lines

1968

PS-network presented to the Advanced Research Projects Agency (ARPA)

Request for proposals for ARPANET sent out in August; responses received in September

University of California Los Angeles (UCLA) awarded Network Measurement Center contract in October

Bolt Beranek and Newman, Inc. (BBN) awarded Packet Switch contract to build Interface Message Processors (IMPs)

US Senator Edward Kennedy sends a congratulatory telegram to BBN for its million-dollar ARPA contract to build the "Interfaith" Message Processor, and thanking them for their ecumenical efforts

Network Working Group (NWG), headed by Steve Crocker, loosely organized to develop host level protocols for communication over the ARPANET. (:vgc:)

Tymnet built as part of Tymshare service (:vgc:)

1969

ARPANET commissioned by DoD for research into networking

Nodes are stood up as BBN builds each IMP [Honeywell DDP-516 mini computer with 12K of memory]; AT&T provides 50kbps lines

Node 1: UCLA (30 August, hooked up 2 September)
- *Function:* Network Measurement Center
- *System,OS:* SDS SIGMA 7, SEX
- Diagram of the first host to IMP connection

Node 2: Stanford Research Institute (SRI) (1 October)
- Network Information Center (NIC)
- SDS940/Genie
- Doug Engelbart's project on "Augmentation of Human Intellect"

Node 3: University of California Santa Barbara (UCSB) (1 November)
- Culler-Fried Interactive Mathematics
- IBM 360/75, OS/MVT

Node 4: University of Utah (December)
- Graphics
- DEC PDP-10, Tenex

Diagram of the 4-node ARPAnet

First Request for Comment (RFC): "Host Software" by Steve Crocker (7 April)

RFC 4: Network Timetable

First packets sent by Charley Kline at UCLA as he tried logging into SRI. The first attempt resulted in the system crashing as the letter G of LOGIN was entered. (October 29) [Log entry]

Univ of Michigan, Michigan State and Wayne State Univ establish X.25-based Merit network for students, faculty, alumni (:sw1:)

1970s

1970

First publication of the original ARPANET Host-Host protocol: C.S. Carr, S. Crocker, V.G. Cerf, "HOST-HOST Communication Protocol in the ARPA Network," in AFIPS Proceedings of SJCC (:vgc:)

First report on ARPANET at AFIPS: "Computer Network Development to Achieve Resource Sharing" (March)

ALOHAnet, the first packet radio network, developed by Norman Abramson, Univ of Hawaii, becomes operational (July) (:sk2:)
- connected to the ARPANET in 1972

ARPANET hosts start using Network Control Protocol (NCP), first host-to-host protocol

First cross-country link installed by AT&T between UCLA and BBN at 56kbps. This line is later replaced by another between BBN and RAND. A second line is added between MIT and Utah

1971

15 nodes (23 hosts): UCLA, SRI, UCSB, Univ of Utah, BBN, MIT, RAND, SDC, Harvard, Lincoln Lab, Stanford, UIU(C), CWRU, CMU, NASA/Ames

BBN starts building IMPs using the cheaper Honeywell 316. IMPs however are limited to 4 host connections, and so BBN develops a terminal IMP (TIP) that supports up to 64 terminals (September)

Ray Tomlinson of BBN invents email program to send messages across a distributed network. The original program was derived from two others: an intra-machine email program (SENDMSG) and an experimental file transfer program (CPYNET) (:amk:irh:)

1972

Ray Tomlinson (BBN) modifies email program for ARPANET where it becomes a quick hit. The @ sign was chosen from the punctuation keys on Tomlinson's Model 33 Teletype for its "at" meaning (March)

Larry Roberts writes first email management program (RD) to list, selectively read, file, forward, and respond to messages (July)

International Conference on Computer Communications (ICCC) at the Washington D.C. Hilton with demonstration of ARPANET between 40 machines and the Terminal Interface Processor (TIP) organized by Bob Kahn. (October)

First computer-to-computer chat takes place at UCLA, and is repeated during ICCC, as psychotic PARRY (at Stanford) discusses its problems with the Doctor (at BBN).

International Network Working Group (INWG) formed in October as a result of a meeting at ICCC identifying the need for a combined effort in advancing networking technologies. Vint Cerf appointed first Chair. By 1974, INWG became IFIP WG 6.1 (:vgc:)

Louis Pouzin leads the French effort to build its own ARPANET - CYCLADES

RFC 318: Telnet specification

1973

First international connections to the ARPANET: University College of London (England) via NORSAR (Norway)

Bob Metcalfe's Harvard PhD Thesis outlines idea for Ethernet. The concept was tested on Xerox PARC's Alto computers, and the first Ethernet network called the Alto Aloha System (May) (:amk:)

Bob Kahn poses Internet problem, starts internetting research program at ARPA. Vinton Cerf sketches gateway architecture in March on back of envelope in a San Francisco hotel lobby (:vgc:)

Cerf and Kahn present basic Internet ideas at INWG in September at Univ of Sussex, Brighton, UK (:vgc:)

RFC 454: File Transfer specification

Network Voice Protocol (NVP) specification (RFC 741) and implementation enabling conference calls over ARPAnet. (:bb1:)

SRI (NIC) begins publishing ARPANET News in March; number of ARPANET users estimated at 2,000

ARPA study shows email composing 75% of all ARPANET traffic

Christmas Day Lockup - Harvard IMP hardware problem leads it to broadcast zero-length hops to any ARPANET destination, causing all other IMPs to send their traffic to Harvard (25 December)

RFC 527: ARPAWOCKY

RFC 602: The Stockings Were Hung by the Chimney with Care

1974

Vint Cerf and Bob Kahn publish "A Protocol for Packet Network Interconnection" which specified in detail the design of a Transmission Control Program (TCP). [IEEE Trans Comm] (:amk:)

BBN opens Telenet, the first public packet data service (a commercial version of ARPANET) (:sk2:)

1975

Operational management of Internet transferred to DCA (now DISA)

First ARPANET mailing list, MsgGroup, is created by Steve Walker. Einar Stefferud soon took over as moderator as the list was not automated at first. A science fiction list, SF-Lovers, was to become the most popular unofficial list in the early days

John Vittal develops MSG, the first all-inclusive email program providing replying, forwarding, and filing capabilities.

Satellite links cross two oceans (to Hawaii and UK) as the first TCP tests are run over them by Stanford, BBN, and UCL

"Jargon File", by Raphael Finkel at SAIL, first released (:esr:)

Shockwave Rider by John Brunner (:pds:)

1976

Elizabeth II, Queen of the United Kingdom sends out an email on 26 March from the Royal Signals and Radar Establishment (RSRE) in Malvern

UUCP (Unix-to-Unix CoPy) developed at AT&T Bell Labs and distributed with UNIX one year later.

Multiprocessing Pluribus IMPs are deployed

1977

THEORYNET created by Larry Landweber at Univ of Wisconsin providing electronic mail to over 100 researchers in computer science (using a locally developed email system over

TELENET)

RFC 733: <u>Mail specification</u>

Tymshare spins out Tymnet under pressure from TELENET. Both go on to develop X.25 protocol standard for virtual circuit style packet switching (:vgc:)

First demonstration of ARPANET/SF Bay Packet Radio Net/Atlantic SATNET operation of Internet protocols with BBN-supplied gateways in July (:vgc:)

1978

TCP split into TCP and IP (March)

RFC 748: <u>TELNET RANDOMLY-LOSE Option</u>

1979

Meeting between Univ of Wisconsin, DARPA, <u>National Science Foundation</u> (NSF), and computer scientists from many universities to establish a Computer Science Department research computer network (organized by Larry Landweber).

USENET established using UUCP between Duke and UNC by Tom Truscott, Jim Ellis, and Steve Bellovin. All original groups were under net.* hierarchy.

First MUD, MUD1, by Richard Bartle and Roy Trubshaw at U of Essex

ARPA establishes the Internet Configuration Control Board (ICCB)

Packet Radio Network (PRNET) experiment starts with DARPA funding. Most communications take place between mobile vans. ARPANET connection via SRI.

On April 12, Kevin MacKenzie emails the MsgGroup a suggestion of adding some emotion back into the dry text medium of email, such as -) for indicating a sentence was tongue-in-cheek. Though flamed by many at the time, emoticons became widely used

---

1980s

1980

ARPANET grinds to a complete halt on 27 October because of an accidentally-propagated status-message virus

First C/30-based IMP at BBN

1981

<u>BITNET</u>, the "Because It's Time NETwork"
  - Started as a cooperative network at the City University of New York, with the first connection to Yale (:feg:)
  - Original acronym stood for 'There' instead of 'Time' in reference to the free NJE protocols provided with the IBM systems

  - Provides electronic mail and listserv servers to distribute information, as well as file transfers

CSNET (Computer Science NETwork) built by a collaboration of computer scientists and Univ of Delaware, Purdue Univ, Univ of Wisconsin, RAND Corporation and BBN through seed money granted by NSF to provide networking services (especially email) to university scientists with no access to ARPANET. CSNET later becomes known as the Computer and Science Network. (:amk,lhl:)

C/30 IMPs predominate the network; first C/30 TIP at SAC

Minitel (Teletel) is deployed across France by France Telecom.

True Names by Vernor Vinge (:pds:)

RFC 801: NCP/TCP Transition Plan

1982

Norway leaves network to become an Internet connection via TCP/IP over SATNET; UCL does the same

DCA and ARPA establish the Transmission Control Protocol (TCP) and Internet Protocol (IP), as the protocol suite, commonly known as TCP/IP, for ARPANET. (:vgc:)
  - This leads to one of the first definitions of an "internet" as a connected set of networks, specifically those using TCP/IP, and "Internet" as connected TCP/IP internets.
  - DoD declares TCP/IP suite to be standard for DoD (:vgc:)

EUnet (European UNIX Network) is created by EUUG to provide email and USENET services. (:glg:)
  - original connections between the Netherlands, Denmark, Sweden, and UK

Exterior Gateway Protocol (RFC 827) specification. EGP is used for gateways between networks.

1983

Name server developed at Univ of Wisconsin, no longer requiring users to know the exact path to other systems

Cutover from NCP to TCP/IP (1 January)

No more Honeywell or Pluribus IMPs; TIPs replaced by TACs (terminal access controller)

Stuttgart and Korea get connected

Movement Information Net (MINET) started early in the year in Europe, connected to Internet in Sept

CSNET / ARPANET gateway put in place

ARPANET split into ARPANET and MILNET; the latter became integrated with the Defense Data Network created the previous year. 68 of the 113 existing nodes went to MILNET

Desktop workstations come into being, many with Berkeley UNIX (4.2 BSD) which includes IP networking software (:mpc:)

Networking needs switch from having a single, large time sharing computer connected to the Internet at each site, to instead connecting entire local networks

Internet Activities Board (IAB) established, replacing ICCB

EARN (European Academic and Research Network) established. Very similar to the way BITNET works with a gateway funded by IBM

FidoNet developed by Tom Jennings

1984

Domain Name System (DNS) introduced

Number of hosts breaks 1,000

JUNET (Japan Unix Network) established using UUCP

JANET (Joint Academic Network) established in the UK using the Coloured Book protocols; previously SERCnet

Moderated newsgroups introduced on USENET (mod.*)

Neuromancer by William Gibson

Canada begins a one-year effort to network its universities. The NetNorth Network is connected to BITNET in Ithaca from Toronto (:kfl:)

Kremvax message announcing USSR connectivity to USENET

1985

Whole Earth 'Lectronic Link (WELL) started

Information Sciences Institute (ISI) at USC is given responsibility for DNS root management by DCA, and SRI for DNS NIC registrations

Symbolics.com is assigned on 15 March to become the first registered domain. Other firsts: cmu.edu, purdue.edu, rice.edu, berkeley.edu, ucla.edu, rutgers.edu, bbn.com (24 Apr); mit.edu (23 May); think.com (24 may); css.gov (June); mitre.org, .uk (July)

100 years to the day of the last spike being driven on the cross-Canada railroad, the last Canadian university is connected to NetNorth in a one year effort to have coast-to-coast connectivity. (:kfl:)

RFC 968: 'Twas the Night Before Start-up

1986

NSFNET created (backbone speed of 56Kbps)

- NSF establishes 5 super-computing centers to provide high-computing power for all (JVNC@Princeton, PSC@Pittsburgh, SDSC@UCSD, NCSA@UIUC, Theory Center@Cornell).
- This allows an explosion of connections, especially from universities.

NSF-funded SDSCNET, JVNCNET, SURANET, and NYSERNET operational (:sw1:)

Internet Engineering Task Force (IETF) and Internet Research Task Force (IRTF) comes into existence under the IAB. First IETF meeting held in January at Linkabit in San Diego

The first Freenet (Cleveland) comes on-line 16 July under the auspices of the Society for Public Access Computing (SoPAC). Later Freenet program management assumed by the National Public Telecomputing Network (NPTN) in 1989 (:sk2,rab:)

Network News Transfer Protocol (NNTP) designed to enhance Usenet news performance over TCP/IP.

Mail Exchanger (MX) records developed by Craig Partridge allow non-IP network hosts to have domain addresses.

The great USENET name change; moderated newsgroups changed in 1987.

BARRNET (Bay Area Regional Research Network) established using high speed links. Operational in 1987.

New England gets cut off from the Net as AT&T suffers a fiber optics cable break between Newark/NJ and White Plains/NY. Yes, all seven New England ARPANET trunk lines were in the one severed cable. Outage took place between 1:11 and 12:11 EST on 12 December

1987

NSF signs a cooperative agreement to manage the NSFNET backbone with Merit Network, Inc. (IBM and MCI involvement was through an agreement with Merit). Merit, IBM, and MCI later founded ANS.

UUNET is founded with Usenix funds to provide commercial UUCP and Usenet access. Originally an experiment by Rick Adams and Mike O'Dell

First TCP/IP Interoperability Conference (March), name changed in 1988 to INTEROP

Email link established between Germany and China using CSNET protocols, with the first message from China sent on 20 September. (:wz1:)

The concept and plan for a national US research and education network is proposed by Gordon Bell et al in a report to the Office of Science and Technology, written in response to a congressional request by Al Gore. (Nov) It would take four years until the establishment of this network by Congress (:gb1:)

1000th RFC: "Request For Comments reference guide"

Number of hosts breaks 10,000

Number of BITNET hosts breaks 1,000

1988

2 November - Internet worm burrows through the Net, affecting ~6,000 of the 60,000 hosts on the Internet (:ph1:)

CERT (Computer Emergency Response Team) formed by DARPA in response to the needs exhibited during the Morris worm incident. The worm is the only advisory issued this year.

DoD chooses to adopt OSI and sees use of TCP/IP as an interim. US Government OSI Profile (GOSIP) defines the set of protocols to be supported by Government purchased products (:gck:)

Los Nettos network created with no federal funding, instead supported by regional members (founding: Caltech, TIS, UCLA, USC, ISI).

NSFNET backbone upgraded to T1 (1.544Mbps)

CERFnet (California Education and Research Federation network) founded by Susan Estrada.

Internet Assigned Numbers Authority (IANA) established in December with Jon Postel as its Director. Postel was also the RFC Editor and US Domain registrar for many years.

Internet Relay Chat (IRC) developed by Jarkko Oikarinen (:zby:)

First Canadian regionals join NSFNET: ONet via Cornell, RISQ via Princeton, BCnet via Univ of Washington (:ec1:)

FidoNet gets connected to the Net, enabling the exchange of email and news (:tp1:)

The first multicast tunnel is established between Stanford and BBN in the Summer of 1988.

Countries connecting to NSFNET: Canada (CA), Denmark (DK), Finland (FI), France (FR), Iceland (IS), Norway (NO), Sweden (SE)

1989

Number of hosts breaks 100,000

RIPE (Reseaux IP Europeens) formed (by European service providers) to ensure the necessary administrative and technical coordination to allow the operation of the pan-European IP Network. (:glg:)

First relays between a commercial electronic mail carrier and the Internet: MCI Mail through the Corporation for the National Research Initiative (CNRI), and CompuServe through Ohio State Univ (:jg1,ph1:)

Corporation for Research and Education Networking (CREN) is formed by merging CSNET into BITNET (August)

AARNET - Australian Academic Research Network - set up by AVCC and CSIRO; introduced

into service the following year (:gmc:)

First link between Australia and NSFNET via Hawaii on 23 June

Cuckoo's Egg by Clifford Stoll tells the real-life tale of a German cracker group who infiltrated numerous US facilities

UCLA sponsors the Act One symposium to celebrate ARPANET's 20th anniversary and its decommissioning (August)

RFC 1121: Act One - The Poems

RFC 1097: TELNET SUBLIMINAL-MESSAGE Option

Countries connecting to NSFNET: Australia (AU), Germany (DE), Israel (IL), Italy (IT), Japan (JP), Mexico (MX), Netherlands (NL), New Zealand (NZ), Puerto Rico (PR), United Kingdom (UK)

1990s

1990

ARPANET ceases to exist

Electronic Frontier Foundation (EFF) is founded by Mitch Kapor

Archie released by Peter Deutsch, Alan Emtage, and Bill Heelan at McGill

Hytelnet released by Peter Scott (Univ of Saskatchewan)

The World comes on-line (world.std.com), becoming the first commercial provider of Internet dial-up access

ISO Development Environment (ISODE) developed to provide an approach for OSI migration for the DoD. ISODE software allows OSI application to operate over TCP/IP (:gck:)

CA*net formed by 10 regional networks as national Canadian backbone with direct connection to NSFNET (:ec1:)

The first remotely operated machine to be hooked up to the Internet, the Internet Toaster by John Romkey, (controlled via SNMP) makes its debut at Interop.

RFC 1149: A Standard for the Transmission of IP Datagrams on Avian Carriers. Implementation is completed 11 years later by the Bergen Linux Users Group (28 Apr 2001)

RFC 1178: Choosing a Name for Your Computer

Countries connecting to NSFNET: Argentina (AR), Austria (AT), Belgium (BE), Brazil (BR), Chile (CL), Greece (GR), India (IN), Ireland (IE), Korea (KR), Spain (ES), Switzerland (CH)

1991

First connection takes place between Brazil, by <u>Fapesp</u>, and the Internet at 9600 baud.

Commercial Internet eXchange (CIX) Association, Inc. formed by General Atomics (CERFnet), Performance Systems International, Inc. (PSInet), and UUNET Technologies, Inc. (AlterNet), after NSF lifts restrictions on the commercial use of the Net (March) (:glg:)

Wide Area Information Servers (WAIS), invented by Brewster Kahle, released by Thinking Machines Corporation

Gopher released by Paul Lindner and Mark P. McCahill from the Univ of Minnesota

<u>World-Wide Web (WWW)</u> released by <u>CERN</u>; Tim Berners-Lee developer (:pb1:)

PGP (Pretty Good Privacy) released by Philip Zimmerman (:ad1:)

US High Performance Computing Act (Gore 1) establishes the National Research and Education Network (NREN)

NSFNET backbone upgraded to T3 (44.736Mbps)

NSFNET traffic passes 1 trillion bytes/month and 10 billion packets/month

Defense Data Network NIC contract awarded by DISA to Government Systems Inc. who takes over from SRI in May

Start of JANET IP Service (JIPS) which signaled the changeover from Coloured Book software to TCP/IP within the UK academic network. IP was initially 'tunneled' within X.25. (:gst:)

RFC 1216: <u>Gigabit Network Economics and Paradigm Shifts</u>

RFC 1217: <u>Memo from the Consortium for Slow Commotion Research (CSCR)</u>

Countries connecting to NSFNET: Croatia (HR), Czech Republic (CZ), Hong Kong (HK), Hungary (HU), Poland (PL), Portugal (PT), Singapore (SG), South Africa (ZA), Taiwan (TW), Tunisia (TN)

1992

Internet Society (ISOC) is chartered (January)

IAB reconstituted as the Internet Architecture Board and becomes part of the Internet Society

Number of hosts breaks 1,000,000

First MBONE audio multicast (March) and video multicast (November)

<u>RIPE</u> Network Coordination Center (NCC) created in April to provide address registration and coordination services to the European Internet community (:dk1:)

Veronica, a gopherspace search tool, is released by Univ of Nevada

World Bank comes on-line

The term "surfing the Internet" is coined by Jean Armour Polly (:jap:)

Zen and the Art of the Internet is published by Brendan Kehoe (:jap:)

Internet Hunt started by Rick Gates

RFC 1300: Remembrances of Things Past

RFC 1313: Today's Programming for KRFC AM 1313 - Internet Talk Radio

Countries connecting to NSFNET: Antarctica (AQ), Cameroon (CM), Cyprus (CY), Ecuador (EC), Estonia (EE), Kuwait (KW), Latvia (LV), Luxembourg (LU), Malaysia (MY), Slovakia (SK), Slovenia (SI), Thailand (TH), Venezuela (VE)

1993

InterNIC created by NSF to provide specific Internet services: (:sc1:)
- directory and database services (AT&T)
- registration services (Network Solutions Inc.)
- information services (General Atomics/CERFnet)

US White House comes on-line (http://www.whitehouse.gov/):
- President Bill Clinton: president@whitehouse.gov
- Vice-President Al Gore: vice-president@whitehouse.gov

Worms of a new kind find their way around the Net - WWW Worms (W4), joined by Spiders, Wanderers, Crawlers, and Snakes ...

Internet Talk Radio begins broadcasting (:sk2:)

United Nations (UN) comes on-line (:vgc:)

US National Information Infrastructure Act

Businesses and media begin taking notice of the Internet

InterCon International KK (IIKK) provides Japan's first commercial Internet connection in September. TWICS, though an IIKK leased line, begins offering dial-up accounts the following month (:tb1:)

Mosaic takes the Internet by storm; WWW proliferates at a 341,634% annual growth rate of service traffic. Gopher's growth is 997%.

RFC 1437: The Extension of MIME Content-Types to a New Medium

RFC 1438: IETF Statements of Boredom (SOBs)

Countries connecting to NSFNET: Bulgaria (BG), Costa Rica (CR), Egypt (EG), Fiji (FJ), Ghana (GH), Guam (GU), Indonesia (ID), Kazakhstan (KZ), Kenya (KE), Liechtenstein (LI), Peru (PE), Romania (RO), Russian Federation (RU), Turkey (TR), Ukraine (UA), UAE (AE), US Virgin Islands (VI)

1994

ARPANET/Internet celebrates 25th anniversary

Communities begin to be wired up directly to the Internet (Lexington and Cambridge, Mass., USA)

US Senate and House provide information servers

Shopping malls arrive on the Internet

First cyberstation, RT-FM, broadcasts from Interop in Las Vegas

The National Institute for Standards and Technology (NIST) suggests that GOSIP should incorporate TCP/IP and drop the "OSI-only" requirement (:gck:)

Arizona law firm of Canter & Siegel "spams" the Internet with email advertising green card lottery services; Net citizens flame back

NSFNET traffic passes 10 trillion bytes/month

Yes, it's true - you can now order pizza from the Hut online

WWW edges out telnet to become 2nd most popular service on the Net (behind ftp-data) based on % of packets and bytes traffic distribution on NSFNET

Japanese Prime Minister on-line (http://www.kantei.go.jp/)

UK's HM Treasury on-line (http://www.hm-treasury.gov.uk/)

New Zealand's Info Tech Prime Minister on-line (http://www.govt.nz/)

First Virtual, the first cyberbank, open up for business

Radio stations start rockin' (rebroadcasting) round the clock on the Net: WXYC at Univ of NC, KJHK at Univ of KS-Lawrence, KUGS at Western WA Univ

IPng recommended by IETF at its Toronto meeting (July) and approved by IESG in November. Later documented as RFC 1752

The first banner ads appear on hotwired.com in October. They were for Zima (a beverage) and AT&T

Trans-European Research and Education Network Association (TERENA) is formed by the merger of RARE and EARN, with representatives from 38 countries as well as CERN and ECMWF. TERENA's aim is to "promote and participate in the development of a high quality

international information and telecommunications infrastructure for the benefit of research and education" (October)

After noticing that many network software vendors used domain.com in their documentation examples, Bill Woodcock and Jon Postel register the domain. Sure enough, after looking at the domain access logs, it was evident that many users were using the example domain in configuring their applications.

RFC 1605: SONET to Sonnet Translation

RFC 1606: A Historical Perspective On The Usage Of IP Version 9

RFC 1607: A VIEW FROM THE 21ST CENTURY

Countries connecting to NSFNET: Algeria (DZ), Armenia (AM), Bermuda (BM), Burkina Faso (BF), China (CN), Colombia (CO), Jamaica (JM), Jordan (JO), Lebanon (LB), Lithuania (LT), Macao (MO), Morocco (MA), New Caledonia (NC), Nicaragua (NI), Niger (NE), Panama (PA), Philippines (PH), Senegal (SN), Sri Lanka (LK), Swaziland (SZ), Uruguay (UY), Uzbekistan (UZ)

Top 10 Domains by Host #: com, edu, uk, gov, de, ca, mil, au, org, net

1995

NSFNET reverts back to a research network. Main US backbone traffic now routed through interconnected network providers

The new NSFNET is born as NSF establishes the very high speed Backbone Network Service (vBNS) linking super-computing centers: NCAR, NCSA, SDSC, CTC, PSC

Neda Rayaneh Institute (NRI), Iran's first commercial provider, comes online, connecting via satellite to Cadvision, a Canadian provider (:rm1:)

Hong Kong police disconnect all but one of the colony's Internet providers for failure to obtain a license; thousands of users are left without service (:kf2:)

Sun launches JAVA on May 23

RealAudio, an audio streaming technology, lets the Net hear in near real-time

Radio HK, the first commercial 24 hr., Internet-only radio station starts broadcasting

WWW surpasses ftp-data in March as the service with greatest traffic on NSFNet based on packet count, and in April based on byte count

Traditional online dial-up systems (CompuServe, America Online, Prodigy) begin to provide Internet access

Thousands in Minneapolis-St. Paul (USA) lose Net access after transients start a bonfire under a bridge at the Univ of MN causing fiber-optic cables to melt (30 July)

A number of Net related companies go public, with Netscape leading the pack with the 3rd largest

ever NASDAQ IPO share value (9 August)

Registration of domain names is no longer free. Beginning 14 September, a $50 annual fee has been imposed, which up until now was subsidized by NSF. NSF continues to pay for .edu registration, and on an interim basis for .gov

The Vatican comes on-line (http://www.vatican.va/)

The Canadian Government comes on-line (http://canada.gc.ca/)

The first official Internet wiretap was successful in helping the Secret Service and Drug Enforcement Agency (DEA) apprehend three individuals who were illegally manufacturing and selling cell phone cloning equipment and electronic devices

Operation Home Front connects, for the first time, soldiers in the field with their families back home via the Internet.

Richard White becomes the first person to be declared a munition, under the USA's arms export control laws, because of an RSA file security encryption program tattooed on his arm (:wired496:)

RFC 1882: The 12-Days of Technology Before Christmas

Country domains registered: Ethiopia (ET), Cote d'Ivoire (CI), Cook Islands (CK) Cayman Islands (KY), Anguilla (AI), Gibraltar (GI), Vatican (VA), Kiribati (KI), Kyrgyzstan (KG), Madagascar (MG), Mauritius (MU), Micronesia (FM), Monaco (MC), Mongolia (MN), Nepal (NP), Nigeria (NG), Western Samoa (WS), San Marino (SM), Tanzania (TZ), Tonga (TO), Uganda (UG), Vanuatu (VU)

Top 10 Domains by Host #: com, edu, net, gov, mil, org, de, uk, ca, au

Technologies of the Year: WWW, Search engines

Emerging Technologies: Mobile code (JAVA, JAVAscript), Virtual environments (VRML), Collaborative tools

Hacks of the Year: The Spot (Jun 12), Hackers Movie Page (12 Aug)

1996

Internet phones catch the attention of US telecommunication companies who ask the US Congress to ban the technology (which has been around for years)

Malaysian Prime Minister Mahathir Mohamad, PLO Leader Yasser Arafat, and Phillipine President Fidel Ramos meet for ten minutes in an online interactive chat session on 17 January.

The controversial US Communications Decency Act (CDA) becomes law in the US in order to prohibit distribution of indecent materials over the Net. A few months later a three-judge panel imposes an injunction against its enforcement. Supreme Court unanimously rules most of it unconstitutional in 1997.

9,272 organizations find themselves unlisted after the InterNIC drops their name service as a result

of not having paid their domain name fee

Various ISPs suffer extended service outages, bringing into question whether they will be able to handle the growing number of users. AOL (19 hours), Netcom (13 hours), AT&T WorldNet (28 hours - email only)

Domain name tv.com sold to CNET for US$15,000

New York's Public Access Networks Corp (PANIX) is shut down after repeated SYN attacks by a cracker using methods outlined in a hacker magazine (2600)

MCI upgrades Internet backbone adding ~13,000 ports, bringing the effective speed from 155Mbps to 622Mbps.

The Internet Ad Hoc Committee announces plans to add 7 new generic Top Level Domains (gTLD): .firm, .store, .web, .arts, .rec, .info, .nom. The IAHC plan also calls for a competing group of domain registrars worldwide.

A malicious cancelbot is released on USENET wiping out more than 25,000 messages

The WWW browser war, fought primarily between Netscape and Microsoft, has rushed in a new age in software development, whereby new releases are made quarterly with the help of Internet users eager to test upcoming (beta) versions.

RFC 1925: The Twelve Networking Truths

Restrictions on Internet use around the world:
  o *China:* requires users and ISPs to register with the police
  o *Germany:* cuts off access to some newsgroups carried on CompuServe
  o *Saudi Arabia:* confines Internet access to universities and hospitals
  o *Singapore:* requires political and religious content providers to register with the state
  o *New Zealand:* classifies computer disks as "publications" that can be censored and seized
  o *source: Human Rights Watch*

Country domains registered: Qatar (QA), Central frican Republic (CF), Oman (OM), Norfolk Island (NF), Tuvalu (TV), French Polynesia (PF), Syria (SY), Aruba (AW), Cambodia (KH), French Guiana (GF), Eritrea (ER), Cape Verde (CV), Burundi (BI), Benin (BJ) Bosnia-Herzegovina (BA), Andorra (AD), Guadeloupe (GP), Guernsey (GG), Isle of Man (IM), Jersey (JE), Lao (LA), Maldives (MV), Marshall Islands (MH), Mauritania (MR), Northern Mariana Islands (MP), Rwanda (RW), Togo (TG), Yemen (YE), Zaire (ZR)

Top 10 Domains by Host #: com, edu, net, uk, de, jp, us, mil, ca, au

Hacks of the Year: US Dept of Justice (17 Aug), CIA (19 Sep), Air Force (29 Dec), UK Labour Party (6 Dec), NASA DDCSOL - USAFE - US Air Force (30 Dec)

Technologies of the Year: Search engines, JAVA, Internet Phone

Emerging Technologies: Virtual environments (VRML), Collaborative tools, Internet appliance (Network Computer)

1997

2000th RFC: "Internet Official Protocol Standards"

71,618 mailing lists registered at Liszt, a mailing list directory

The American Registry for Internet Numbers (ARIN) is established to handle administration and registration of IP numbers to the geographical areas currently handled by Network Solutions (InterNIC), starting March 1998.

CA*net II launched in June to provide Canada's next generation Internet using ATM/SONET

In protest of the DNS monopoly, AlterNIC's owner, Eugene Kashpureff, hacks DNS so users going to www.internic.net end up at www.alternic.net

Domain name business.com sold for US$150,000

Early in the morning of 17 July, human error at Network Solutions causes the DNS table for .com and .net domains to become corrupted, making millions of systems unreachable.

Longest hostname registered with InterNIC:
CHALLENGER.MED.SYNAPSE.UAH.UALBERTA.CA

101,803 Name Servers in whois database

RFC 2100: The Naming of Hosts

Country domains registered: Falkland Islands (FK), East Timor (TP), R of Congo (CG), Christmas Island (CX), Gambia (GM), Guinea-Bissau (GW), Haiti (HT), Iraq (IQ), Libya (LY), Malawi (MW), Martinique (MQ), Montserrat (MS), Myanmar (MM), French Reunion Island (RE), Seychelles (SC), Sierra Leone (SL), Somalia (SO), Sudan (SD), Tajikistan (TJ), Turkmenistan (TM), Turks and Caicos Islands (TC), British Virgin Islands (VG), Heard and McDonald Islands (HM), French Southern Territories (TF), British Indian Ocean Territory (IO), Svalbard and Jan Mayen Islands (SJ), St Pierre and Miquelon (PM), St Helena (SH), South Georgia/Sandwich Islands (GS), Sao Tome and Principe (ST), Ascension Island (AC), US Minor Outlying Islands (UM), Mayotte (YT), Wallis and Futuna Islands (WF), Tokelau Islands (TK), Chad Republic (TD), Afghanistan (AF), Cocos Island (CC), Bouvet Island (BV), Liberia (LR), American Samoa (AS), Niue (NU), Equatorial New Guinea (GQ), Bhutan (BT), Pitcairn Island (PN), Palau (PW), DR of Congo (CD)

Top 10 Domains by Host #: com, edu, net, jp, uk, de, us, au, ca, mil

Hacks of the Year: Indonesian Govt (19 Jan, 10 Feb, 24 Apr, 30 Jun, 22 Nov), NASA (5 Mar), UK Conservative Party (27 Apr), Spice Girls (14 Nov)

Technologies of the Year: Push, Multicasting

Emerging Technologies: Push

1998

Hobbes' Internet Timeline is released as RFC 2235 & FYI 32

US Depart of Commerce (DoC) releases the Green Paper outlining its plan to privatize DNS on 30 January. This is followed up by a White Paper on June 5

La Fête de l'Internet, a country-wide Internet fest, is held in France 20-21 March

Web size estimates range between 275 (Digital) and 320 (NEC) million pages for 1Q

Companies flock to the Turkmenistan NIC in order to register their name under the .tm domain, the English abbreviation for trademark

Internet users get to be judges in a performance by 12 world champion ice skaters on 27 March, marking the first time a television sport show's outcome is determined by its viewers.

Network Solutions registers its 2 millionth domain on 4 May

Electronic postal stamps become a reality, with the US Postal Service allowing stamps to be purchased and downloaded for printing from the Web.

Canada kicks off CA*net 3, the first national optical internet

Compaq pays US$3.3million for altavista.com

CDA II and a ban on Net taxes are signed into US law (21 October)

ABCNews.com accidentally posts test US election returns one day early (2 November)

Indian ISP market is deregulated in November causing a rush for ISP operation licenses

US DoC enters into an agreement with the Internet Corporation for Assigned Numbers (ICANN) to establish a process for transitioning DNS from US Government management to industry (25 November)

San Francisco sites without off-city mirrors go offline as the city blacks out on 8 December

Chinese government puts Lin Hai on trial for "inciting the overthrow of state power" for providing 30,000 email addresses to a US Internet magazine (December) [He is later sentenced to two years in jail]

French Internet users give up their access on 13 December to boycott France Telecom's local phone charges (which are in addition to the ISP charge)

Open source software comes of age

RFC 2321: RITA -- The Reliable Internetwork Troubleshooting Agent

RFC 2322: Management of IP numbers by peg-dhcp

RFC 2323: IETF Identification and Security Guidelines

RFC 2324: Hyper Text Coffee Pot Control Protocol (HTCPCP/1.0)

Country domains registered: Nauru (NR), Comoros (KM)

Bandwidth Generators: Winter Olympics (Feb), World Cup (Jun-Jul), Starr Report (11 Sep), Glenn space launch

Top 10 Domains by Host #: com, net, edu, mil, jp, us, uk ,de, ca, au

Hacks of the Year: US Dept of Commerce (20 Feb), New York Times (13 Sep), China Society for Human Rights Studies (26 Oct), UNICEF (7 Jan)

Technologies of the Year: E-Commerce, E-Auctions, Portals

Emerging Technologies: E-Trade, XML, Intrusion Detection

1999

Internet access becomes available to the Saudi Arabian (.sa) public in January

vBNS sets up an OC48 link between CalREN South and North using Juniper M40 routers

First Internet Bank of Indiana, the first full-service bank available only on the Net, opens for business on 22 February

IBM becomes the first Corporate partner to be approved for Internet2 access

European Parliament proposes banning the caching of Web pages by ISPs

The Internet Fiesta kicks off in March across Europe, building on the success of La Fête de l'Internet held in 1998

US State Court rules that domain names are property that may be garnished

MCI/Worldcom, the vBNS provider for NSF, begins upgrading the US backbone to 2.5GBps

A forged Web page made to look like a Bloomberg financial news story raised shares of a small technology company by 31% on 7 April.

ICANN announces the five testbed registrars for the competitive Shared Registry System on 21 April: AOL, CORE, France Telecom/Oléane, Melbourne IT, Register.com. 29 additional post-testbed registrars are also selected on 21 April, followed by 8 on 25 May, 15 on 6 July, and so on for a total of 98 by year's end. The testbed, originally scheduled to last until 24 June, is extended until 10 September, and then 30 November. The first registrar to come online is Register.com on 7 June

First large-scale Cyberwar takes place simultaneously with the war in Serbia/Kosovo

Abilene, the Internet2 network, reaches across the Atlantic and connects to NORDUnet and SURFnet

The Web becomes the focal point of British politics as a list of MI6 agents is released on a UK Web site. Though forced to remove the list from the site, it was too late as the list had already been replicated across the Net. (15 May)

Activists Net-wide target the world's financial centers on 18 June, timed to coincide with the G8 Summit. Little actual impact is reported.

MCI/Worldcom launches vBNS+, a commercialized version of vBNS targeted at smaller educational and research institutions

Somalia gets its first ISP - Olympic Computer (Sep)

ISOC approves the formation of the Internet Societal Task Force (ISTF). Vint Cerf serves as first chair

Free computers are all the rage (as long as you sign a long term contract for Net service)

.ps is registered to Palestine (11 Oct)

vBNS reaches 101 connections

business.com is sold for US$7.5million (it was purchased in 1997 for US$150,000 (30 Nov)

RFC 2549: IP over Avian Carriers with Quality of Service

RFC 2550: Y10K and Beyond

RFC 2551: The Roman Standards Process -- Revision III

RFC 2555: 30 Years of RFCs

RFC 2626: The Internet and the Millennium Problem (Year 2000)

Top 10 TLDs by Host #: com, net, edu, jp, uk, mil, us, de, ca, au

Hacks of the Year: Star Wars (8 Jan), .tp (Jan), USIA (23 Jan), E-Bay (13 Mar), US Senate (27 May), NSI (2 Jul), Paraguay Gov't (20 Jul), AntiOnline (5 Aug), Microsoft (26 Oct), UK Railtrack (31 Dec)

Technologies of the Year: E-Trade, Online Banking, MP3

Emerging Technologies: Net-Cell Phones, Thin Computing, Embedded Computing

Viruses of the Year: Melissa (March), ExploreZip (June)

2000s

2000

The US timekeeper (USNO) and a few other time services around the world report the new year as 19100 on 1 Jan

A massive denial of service attack is launched against major web sites, including Yahoo, Amazon, and eBay in early February

Web size estimates by NEC-RI and Inktomi surpass 1 billion indexable pages

ICANN redelegates the .pn domain, returning it to the Pitcairn Island community (February)

Internet2 backbone network deploys IPv6 (16 May)

Various domain name hijackings took place in late May and early June, including internet.com, bali.com, and web.net

A testbed allowing the registration of domain names in Chinese, Japanese, and Korean begins operation on 9 November. This testbed, created by VeriSign without IETF authorization, only allows the second-level domain to be non-English, still forcing use of .com, .net, .org. The Chinese government blocks internal registrations, stating that registrations in Chinese are its sovereignty right

ICANN selects new TLDs: .aero, .biz, .coop, .info, .museum, .name, .pro (16 Nov)

Mexico's connection to Internet2 becomes fully operational as the California research network (CalREN-2) is connected with Mexico's Corporación Universitaria para el Desarrollo de Internet (CUDI) network. Though connected in November, the link's inauguration by California's Governor and Mexico's President was not until March of 2001.

After months of legal proceedings, the French court rules Yahoo! must block French users from accessing hate memorabilia in its auction site (Nov). Given its inability to provide such a block on the Internet, Yahoo! removes those auctions entirely (Jan 2001).

The European Commission contracts with a consortium of 30 national research networks for the development of Géant, Europe's new gigabit research network meant to enhance the current capability provided by TEN-155 (6 Nov)

Australian government endorses the transfer of authority for the .au domain to auDA (18 Dec). ICANN signs over control to auDA on 26 Oct 2001.

RFC 2795: The Infinite Monkey Protocol Suite

Hacks of the Year: RSA Security (Feb), Apache (May), Western Union (Sep), Microsoft (Oct)

Technologies of the Year: ASP, Napster

Emerging Technologies: Wireless devices, IPv6

Viruses of the Year: Love Letter (May)

Lawsuits of the Year: Napster, DeCSS

2001

The first live distributed musical -- *The Technophobe & The Madman* -- over Internet2 networks debuts on 20 Feb

VeriSign extends its multilingual domain testbed to encompass various European languages (26 Feb), and later the full Unicode character set (5 Apr) opening up most of the world's languages

Forwarding email in Australia becomes illegal with the passing of the Digital Agenda Act, as it is seen as a technical infringement of personal copyright (4 Mar)   .

Radio stations broadcasting over the Web go silent over royalty disputes (10 Apr)

High schools in five states (Michigan, Missouri, Oregon, Virginia, and Washington) become the first to gain Internet2 access

US Dept of Commerce issues a notice of intent on 6 April to turn over management for the .edu domain from VeriSign to Educase. Award agreement is reached on 29 October. Community colleges are finally be able to register under .edu

Napster keeps finding itself embroiled in litigation and is eventually forced to suspend service; it comes back later in the year as a subscription service

European Council finalizes an international cybercrime treaty on 22 June and adopts it on 9 November. This is the first treaty addressing criminal offenses committed over the Internet.

.biz and .info are added to the root server on 27 June with registrations beginning in July. .biz domain go live on 7 Nov.

Afghanistan's Taliban bans Internet access country-wide, including from Government offices, in an attempt to control content (13 Jul)

Code Red worm and Sircam virus infiltrate thousands of web servers and email accounts, respectively, causing a spike in Internet bandwidth usage and security breaches (July)

A fire in a train tunnel running through Baltimore, Maryland seriously damages various fiber-optic cable bundles used by backbone providers, disrupting Internet traffic in the Mid-Atlantic states and creating a ripple effect across the US (18 Jul)

Brazil RNP2 is connected to Internet2's Abilene over 45Mbps line (21 Aug)

GEANT, the pan-European Gigabit Research and Education Network, becomes operational (23 Oct), replacing the TEN-155 network which was closed down (30 Nov)

.museum begins resolving (Nov)

First uncompressed real-time gigabit HDTV transmission across a wide-area IP network takes place on Internet2 (12 Nov).

Dutch SURFnet and Internet2's Abilene connect via gigabit ethernet (15 Nov)

.us domain operational responsibility assumed by NeuStar (20 Nov)

RFC 3091: Pi Digit Generation Protocol

RFC 3092: Etymology of "Foo"

RFC 3093: Firewall Enhancement Protocol (FEP)

Viruses of the Year: Code Red (Jul), Nimda (Sep), SirCam (Jul), BadTrans (Apr, Nov)

Emerging Technologies: Grid Computing, P2P

2002

US ISP Association (USISPA) is created from the former CIX (11 Jan)

.name begins resolving (15 Jan)

.coop registrations begin (30 Jan)

.aero registrations begin (18 Mar)

RFC 3251: Electricity over IP

RFC 3252: Binary Lexical Octet Ad-hoc Transport

If you enjoy the Timeline or make use of it in some way, please consider a contribution.

Growth

Internet | Networks | WWW | USENET | Security

Internet growth:

Date	Hosts		Date	Hosts	Networks	Domains
12/69	4		07/89	130,000	650	3,900
06/70	9		10/89	159,000	837	
10/70	11		10/90	313,000	2,063	9,300
12/70	13		01/91	376,000	2,338	
04/71	23		07/91	535,000	3,086	16,000
10/72	31		10/91	617,000	3,556	18,000
01/73	35		01/92	727,000	4,526	
06/74	62		04/92	890,000	5,291	20,000
03/77	111		07/92	992,000	6,569	16,300
12/79	188		10/92	1,136,000	7,505	18,100
08/81	213		01/93	1,313,000	8,258	21,000
05/82	235		04/93	1,486,000	9,722	22,000
08/83	562		07/93	1,776,000	13,767	26,000
10/84	1,024		10/93	2,056,000	16,533	28,000
10/85	1,961		01/94	2,217,000	20,539	30,000

```
· 02/86      2,308  |  07/94 .  3,212,000    25,210     46,000
  11/86      5,089  |  10/94    3,864,000    37,022     56,000
  12/87     28,174  |  01/95    4,852,000   ·39,410     71,000
  07/88     33,000  |  07/95    6,642,000    61,538    120,000
  10/88     56,000  |  01/96    9,472,000    93,671    240,000
  01/89     80,000  |  07/96   12,881,000   134,365    488,000
                    |  01/97   16,146,000               828,000
                    |  07/97   19,540,000             1,301,000
                          *** see Note below ***
```

```
Hosts    = a computer system with registered ip address (an A record)
Networks = registered class A/B/C addresses
Domains  = registered domain name (with name server record)
```

Note: A more accurate survey mechanism was developed in 1/98; new and
      some corrected numbers are shown below. For further info, see
      Sources section.

```
Date     Hosts       |  Date     Hosts       |  Date     Hosts
-----  -----------   +  -----  -----------   +  -----  -----------
01/95    5,846,000   |  01/97   21,819,000   |  01/99   43,230,000
07/95    8,200,000   |  07/97   26,053,000   |  07/99   56,218,000
01/96   14,352,000   |  01/98   29,670,000   |  01/00   72,398,092
07/96   16,729,000   |  07/98   36,739,000   |  07/00   93,047,785
                                             |  01/01  109,574,429
                                             |  07/01  125,888,197
                                             |  01/02  147,344,723
```

Figure: Internet Hosts
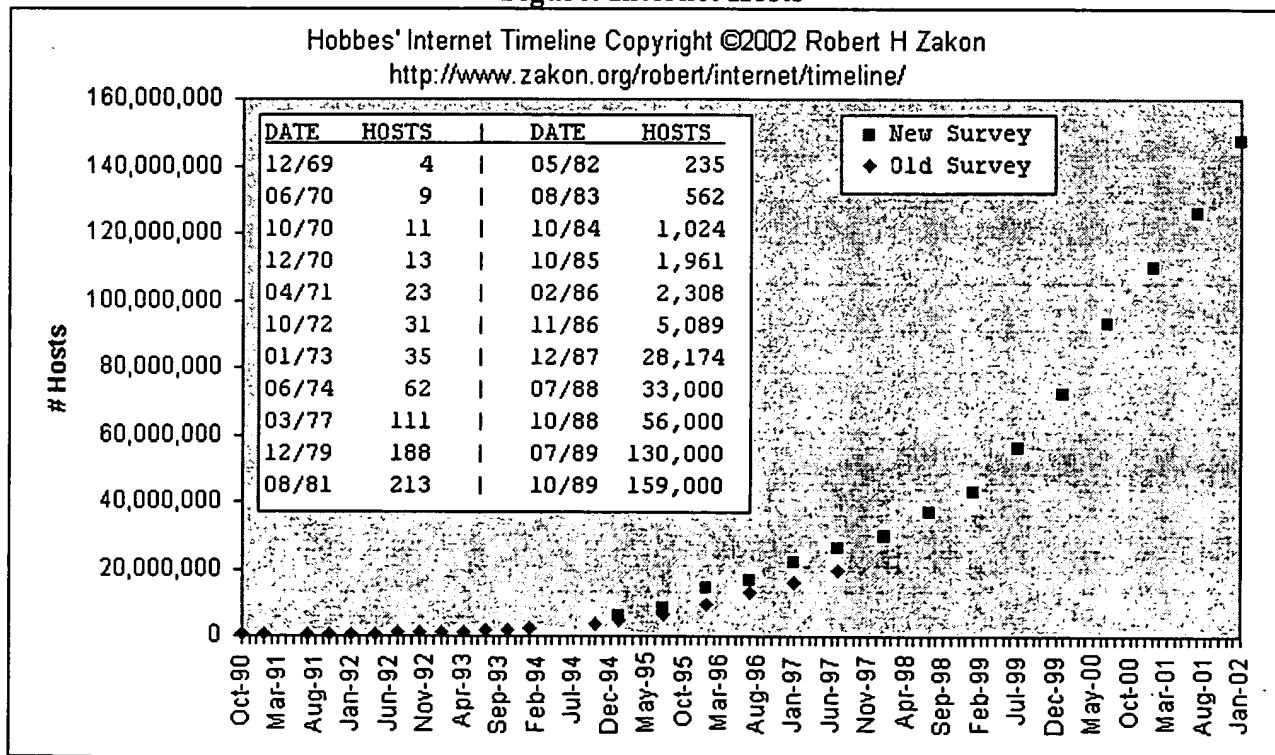
click here for a chart showing the logarithmic growth of the Internet

Figure: Internet Domains

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http://www.zakon.org/robert/internet/timeline/
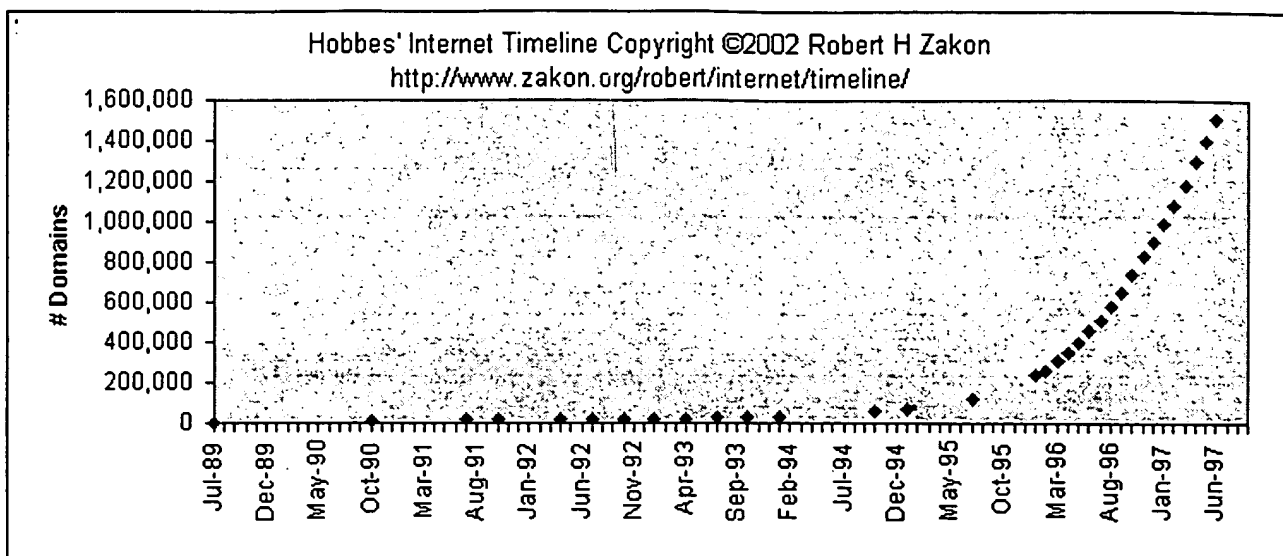
Figure: Internet Networks

Hobbes' Internet Timeline Copyright ©2002 Robert H Zakon
http://www.zakon.org/robert/internet/timeline/
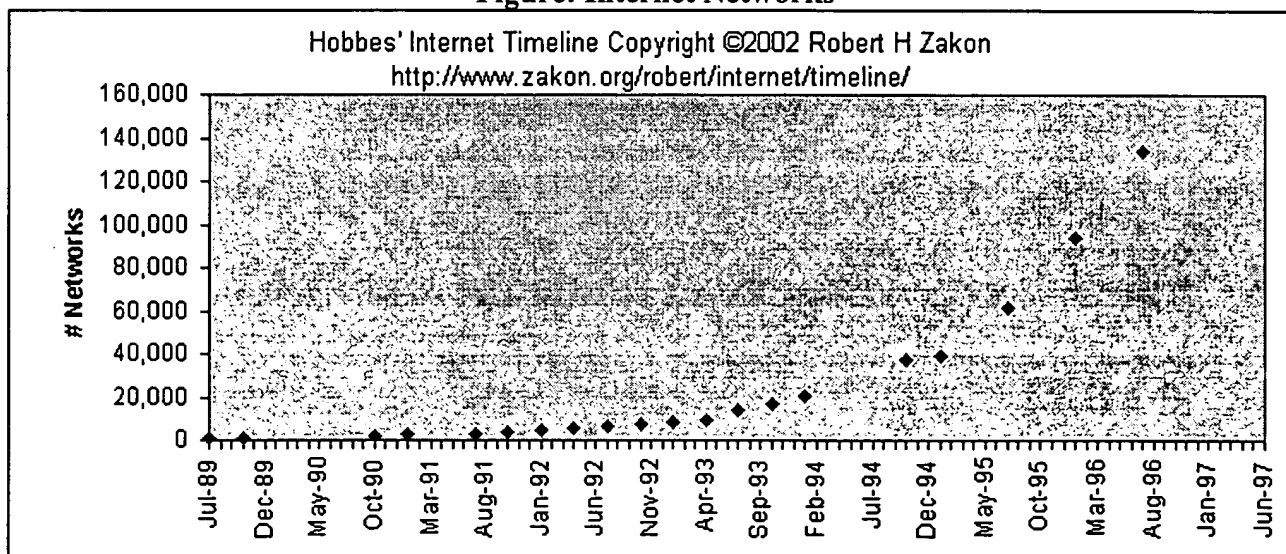
Worldwide Networks Growth: (I)nternet (B)ITNET (U)UCP (F)IDONET (O)SI

Date	# Countries					Date	# Countries				
	I	B	U	F	O		I	B	U	F	O
09/91	31	47	79	49		02/94	62	51	125	88	31
12/91	33	46	78	53		07/94	75	52	129	89	31
02/92	38	46	92	63		11/94	81	51	133	95	--
04/92	40	47	90	66	25	02/95	86	48	141	98	--
08/92	49	46	89	67	26	06/95	96	47	144	99	--
01/93	50	50	101	72	31	06/96	134	--	146	108	--
04/93	56	51	107	79	31	07/97	171	--	147	108	--
08/93	59	51	117	84	31						

Figure: Worldwide Networks Growth

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http://www.zakon.org/robert/internet/timeline/

WWW Growth:

Date	Sites		Date	Sites		Date	Sites
06/93	130		09/97	1,364,714		11/99	8,844,573
09/93	204		10/97	1,466,906		12/99	9,560,866
10/93	228		11/97	1,553,998		01/00	9,950,491
12/93	623		12/97	1,681,868		02/00	11,161,811
06/94	2,738		01/98	1,834,710		03/00	13,106,190
12/94	10,022		02/98	1,920,933		04/00	14,322,950
06/95	23,500		03/98	2,084,473		05/00	15,049,382
01/96	100,000		04/98	2,215,195		06/00	17,119,262
03/96	135,396		05/98	2,308,502		07/00	18,169,498
04/96	150,295		06/98	2,410,067		08/00	19,823,296
05/96	193,150		07/98	2,594,622		09/00	21,166,912
06/96	252,000		08/98	2,807,588		10/00	22,282,727
07/96	299,403		09/98	3,156,324		11/00	23,777,446
08/96	342,081		10/98	3,358,969		12/00	25,675,581
09/96	397,281		11/98	3,518,158		01/01	27,585,719
10/96	462,047		12/98	3,689,227		02/01	28,125,284
11/96	525,906		01/99	4,062,280		03/01	28,611,177
12/96	603,367		02/99	4,301,512		04/01	28,669,939
01/97	646,162		03/99	4,349,131		05/01	29,031,745
02/97	739,688		04/99	5,040,663		06/01	29,302,656
03/97	883,149		05/99	5,414,325		07/01	31,299,592
04/97	1,002,612		06/99	6,177,453		08/01	30,775,624
05/97	1,044,163		07/99	6,598,697		09/01	32,398,046
06/97	1,117,259		08/99	7,078,194		10/01	33,135,768
07/97	1,203,096		09/99	7,370,929		11/01	36,458,394
08/97	1,269,800		10/99	8,115,828		12/01	36,276,252
						01/02	36,689,008
						02/02	38,444,856
						03/02	38,118,962

Sites = # of web servers (one host may have multiple sites by
using different domains or port numbers)

Figure: WWW Growth

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DATE	SITES		DATE	SITES
06/93	130		12/94	10,022
09/93	204		06/95	23,500
10/93	228		01/96	100,000
12/93	623		06/96	252,000
06/94	2,738		07/96	299,403
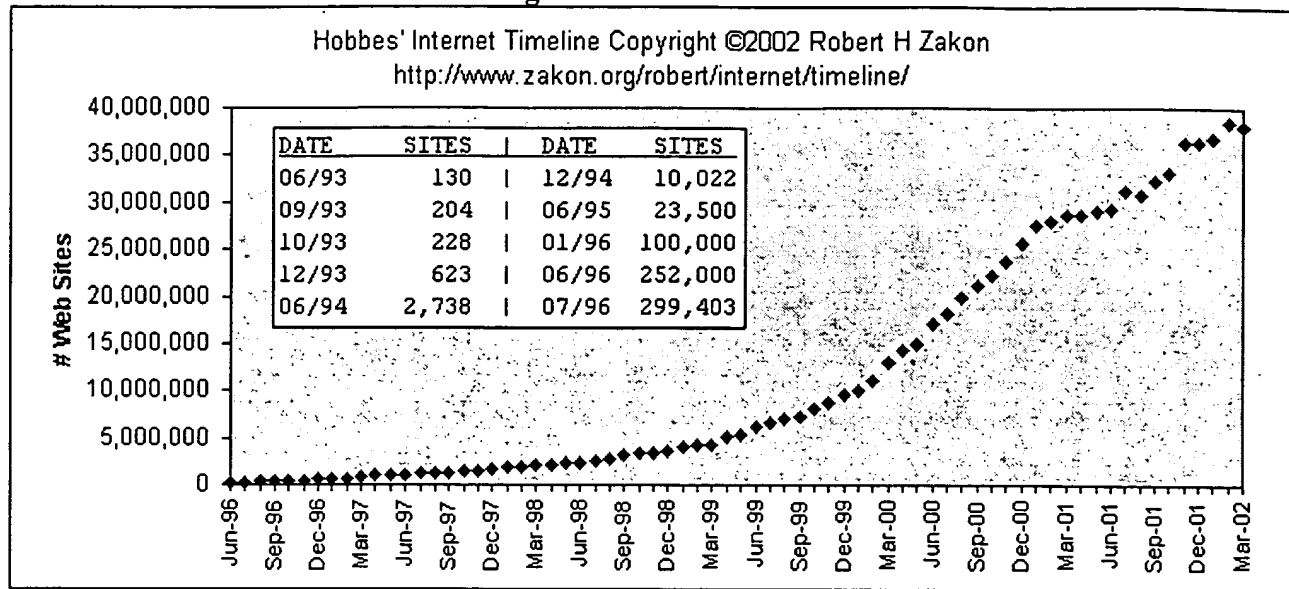
click here for a chart showing the logarithmic growth of the Web

USENET Growth:

Date	Sites	~MB	~Posts	Groups		Date	Sites	~MB	~Posts	Groups
1979	3		2	3		1987	5,200	2	957	259
1980	15		10			1988	7,800	4	1933	381
1981	150	0.05	20			1990	33,000	10	4,500	1,300
1982	400		35			1991	40,000	25	10,000	1,851
1983	600		120			1992	63,000	42	17,556	4,302
1984	900		225			1993	110,000	70	32,325	8,279
1985	1,300	1.0	375			1994	180,000	157	72,755	10,696
1986	2,200	2.0	946	241		1995	330,000	586	131,614	

~ approximate: MB - megabytes per day, Posts - articles per day

Security (CERT) Incidents:

Date	Incidents	Advisories	Vulnerabilities
1988	6	1	
1989	132	7	
1990	252	12	
1991	406	23	
1992	773	21	
1993	1,334	19	
1994	2,340	15	
1995	2,412	18	171
1996	2,573	27	345
1997	2,134	28	311
1998	3,734	13	262
1999	9,859	17	417
2000	21,756	22	774
2001	52,658	37	2,437

Hobbes' Internet Timeline FAQ

1. How do I get Hobbes' Internet Timeline?

The Timeline is archived at http://www.zakon.org/robert/internet/timeline/. Should you only have email access, you can learn how to request this document and access the rest of the Internet by sending an email to one of the following addresses.

- mail-server@rtfm.mit.edu (Americas) with the following line in the *body* of the message: *send usenet/news.answers/internet-services/access-via-email*
- mailbase@mailbase.ac.uk (elsewhere) with the following line in the *body* of the message: *send lis-iis e-access-inet.txt*

2. Is the Timeline available in other languages or editions?

- Chinese (Big5) by Tony Mao
- Chinese (GB) by Guo Li
- French by Didier Mainguy
- German by Michael Kaul
- Italian by Ivo Aceto
- Japanese by Katsunori Tanaka (RFC/FYI translation)
- Persian (PDF) by Rahi Moosavi
- Portuguese by Simone Villas Boas
- Spanish by Pablo Ibarrolaza & Monica Piazza

If you are interested in translating to another language or format, email me first

3. Can I re-print the Timeline or use parts of it for ... ?

Drop me an email. The answer is most likely (though don't assume) 'yes' for non-profit use, and 'maybe' for for-profit; but to be sure you are not going to break any copyright laws, drop me an email and wait for a reply. Also, please note that I get a bunch of requests with improperly formatted return email addresses. If you don't hear from me in a week (typical turn around is < 1 hour), check your header and email again. BTW, don't forget to tell me who you are and your affiliation; anonymous requests will not be answered.

4. What do you do when not updating the Timeline?

For fun: travel, photography, R/C boats, developing technology prototypes ranging from robots, speech to speech translators, and an assortment of Web capabilities. Professionally: evangelize/research/develop advanced Internet, Web, e-commerce and multilingual computing technologies. Explore www.Zakon.org to learn more.

0. Peddie (Ala Viva!), CWRU (North Side), Amici usque ad aras (PHP OH-EP), Colégio Andrews (Rio), Gordonstoun (Elgin)

E-mail me if you know

Sources

Hobbes' Internet Timeline was compiled from a number of sources, with some of the stand-outs being:

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Hauben, Ronda and Michael. "The Netizens and the Wonderful World of the Net."
http://www.columbia.edu/~hauben/netbook/

Kulikowski, Stan II. "A Timeline of Network History." (author's email below)

Quarterman, John. "The Matrix: Computer Networks and Conferencing Systems
Worldwide." Bedford, MA: Digital Press. 1990

"ARPANET, the Defense Data Network, and Internet". Encyclopedia of
Communications, Volume 1.   Editors: Fritz Froehlich, Allen Kent.
New York: Marcel Dekker, Inc. 1991

Internet growth summary compiled from:
  - Zone program reports maintained by Mark Lottor at:
            ftp://ftp.nw.com/pub/zone/
    Note: A more accurate host counting mechanism was used starting
          with 1/98 count.
  - Connectivity table maintained by Larry Landweber at:
            ftp://ftp.cs.wisc.edu/connectivity_table/
  - ARPAnet maps published in various sources

WWW growth summary compiled from:
  - Web growth summary page by Matthew Gray of MIT:
            http://www.mit.edu/people/mkgray/net/web-growth-summary.html
  - Netcraft at http://www.netcraft.com/survey/

USENET growth summary compiled from Quarterman and Hauben sources above,
and news.lists postings. Lots of historical USENET postings also provided
by Tom Fitzgerald (fitz@wang.com).

CERT growth summary compiled from CERT reports at ftp://ftp.cert.org/
CERT stats are also now being made available by CERT at
http://www.cert.org/stats/cert_stats.html

Many of the URLs provided by Arnaud Dufour (arnaud.dufour@hec.unil.ch)

Country-specific Internet Histories:
  - Australia - "A Brief History of the Internet in Australia" by Roger Clarke
          http://www.anu.edu.au/people/Roger.Clarke/II/OzIHist.html
  - Australia - "It Started with a Ping" by Jennie Sinclair
          http://www.aarnet.edu.au/corporate/history/sinclair.html
  - Brazil - "Linha to Tempo da Internet no Brasil" by Érico Guizzo
          http://www.lsi.usp.br/~emguizzo/inetbr/
  - UK - "Early Experiences with the ARPANET and INTERNET in the UK" by Peter Kirste
          http://www.cs.ucl.ac.uk/staff/jon/arpa/internet-history.html

Additional books of interest:
  - "Weaving the Web : The Original Design and Ultimate Destiny of the World Wide We
      by its Inventor"
          by Tim Berners-Lee
  - "Where Wizards Stay Up Late: The Origins of the Internet"
          by Katie Hafner & Matthew Lyon
  - "Nerds 2.0.1: A Brief History of the Internet"
          by Stephen Segaller
  - "Architects of the Web: 1,000 Days That Built the Future of Business"
          by Robert H. Reid
  - "Netizens: On the History and Impact of Usenet and the Internet"
          by Michael Hauben et al
  - "Exploring the Internet: A Technical Travelogue"

                    by Carl Malamud

Early works of interest:
  - "As We May Think" by Vannevar Bush, 1945
        http://www.theatlantic.com/unbound/flashbks/computer/bushf.htm
  - "Man-Computer Symbiosis" by J.C.R. Licklider, 1960
        http://gatekeeper.dec.com/pub/DEC/SRC/research-reports/abstracts/src-rr-061

Contributors to Hobbes' Internet Timeline have their initials next to the
contributed items in the form (:zzz:) and are:

adl - Arnaud Dufour (arnaud.dufour@hec.unil.ch)
amk - Alex McKenzie (mckenzie@bbn.com)
bbl - Billy Brackenridge (billyb@microsoft.com)
clg - C. Lee Giles (giles@research.nj.nec.com)
dkl - Daniel Karrenberg (Daniel.Karrenberg@ripe.net)
ecl - Eric Carroll (eric@enfm.utcc.utoronto.ca)
esr - Eric S. Raymond (esr@locke.ccil.org)
feg - Farrell E. Gerbode (farrell@is.rice.edu)
gbl - Gordon Bell (GBell@microsoft.com)
gck - Gary C. Kessler (kumquat@hill.com)
glg - Gail L. Grant (grant@glgc.com)
gmc - Grant McCall (g.mccall@unsw.edu.au)
gst - Graham Thomas (G.S.Thomas@uel.ac.uk)
irh - Ian R Hardy (hardy@uclink2.berkeley.edu)
jap - Jean Armour Polly (mom@netmom.com)
jgl - Jim Gaynor (gaynor@niherlas.com)
kfl - Ken Fockler (fockler@hq.canet.ca)
kf2 - Kinming Fung (kinming@cuhk.edu.hk)
lbl - Larry Backman (backman@ultranet.com)
lhl - Larry H. Landweber (lhl@cs.wisc.edu)
mpc - Mellisa P. Chase (pc@mitre.org)
pbl - Paul Burchard (burchard@cs.princeton.edu)
pds - Peter da Silva (peter@baileynm.com)
phl - Peter Hoffman (hoffman@ece.nps.navy.mil)
rab - Roger A. Bielefeld (rab@hal.cwru.edu)
rml - Rahi Moosavi (r.moosavi@asrecomputer.com)
scl - Susan Calcari (susanc@is.internic.net)
sk2 - Stan Kulikowski (stankuli@uwf.bitnet) - see sources section
swl - Stephen Wolff (swolff@cisco.com)
tbl - Tim Burress (tim@twics.com)
tpl - Tim Pozar (pozar@kumr.lns.com)
vgc - Vinton Cerf (vcerf@isoc.org) - see sources section
wzl - W. Zorn (zorn@ira.uka.de)
zby - Zenel Batagelj (zenel.batagelj@uni-lj.si)

:-) :-) :-) :-) :-) :-) ;-)   **Help the Author**   (-: (-: (-: (-: (-: (-: (-:

Thank you to the thousands of Net folks who contributed information to help
the author's genealogical search, yielding 45 new Zakon's from around the world!

Archive-name: Hobbes' Internet Timeline
Version: 5.6
Archive-location: http://www.zakon.org/robert/internet/timeline/
Last-updated: 1 April 2002
Maintainer: Robert H'obbes' Zakon, Robert@Zakon.org, www.Zakon.org
Description:
   An Internet timeline highlighting some of the key events and technologies
   which helped shape the Internet as we know it today.